

Customer No.: 31561  
Application No.: 10/064,953  
Docket NO.: 09993-US-212

**In The Claims:**

**Claim 1. (currently amended)** An arc welding quality evaluation apparatus ~~characterized in that, in~~ suitable for a consumable electrode gas-shielded arc welding, wherein a welding voltage is applied between a welding wire and a workpiece to be welded, molten metal droplets from the welding wire are transferred to the workpiece, and that portion of the wire consumed by the transfer of droplets is replenished, for performing continuous arc welding, ~~it comprises the apparatus comprising:~~

a heat input detection means for detecting a heat input applied to the workpiece, from the welding voltage applied thereto and a welding current supplied thereto;

a welding time detection means for detecting a workpiece welding time;

a spatter weight detection means for detecting ~~the~~ a weight of spatter produced during the workpiece welding time;

a heat compensation means for compensating for a heat loss due to spattering during the workpiece welding time;

an effective heat input computation means for computing an effective heat input based on detected values of the heat input detection means and welding time detection means, and a heat compensation value of the heat compensation means; and

a weld quality assessment means for assessing a weld quality based on the degree of separation of an output of the effective heat input computation means from a reference standard value.

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**Claim 2. (currently amended)** An arc welding quality evaluation apparatus ~~characterized in that, in~~ suitable for a consumable electrode gas-shielded arc welding, wherein a welding voltage is applied between a welding wire and a workpiece to be welded, molten metal droplets from the welding wire are transferred to the workpiece, and that portion of the wire consumed by the transfer of droplets is replenished, for performing continuous arc welding, ~~it comprises~~ the apparatus comprising:

a supplied wire weight detection means for detecting ~~the~~ a weight of welding wire supplied;

a spatter weight detection means for detecting ~~the~~ a weight of spatter produced during the workpiece welding time;

a weld metal deposition efficiency computation means for computing an efficiency of deposition of welding wire metal on the workpiece, based on values detected by supplied wire weight detection means and the spatter weight detection means;

a weld quality assessment means for comparing an output value of the weld metal deposition efficiency computation means with a reference standard value, and assessing a weld quality acceptability based on the degree of separation of the computation means output value from the reference standard value.

**Claim 3. (currently amended)** An arc welding quality evaluation apparatus ~~characterized in that, in~~ suitable for a consumable electrode gas-shielded arc welding, wherein a welding voltage is applied between a welding wire and a workpiece to be

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welded, molten metal droplets from the welding wire are transferred to the workpiece, and that portion of the wire consumed by the transfer of droplets is replenished, for performing continuous arc welding, ~~it comprises~~ the apparatus comprising:

a supplied wire weight detection means for detecting ~~the~~ a weight of welding wire supplied;

a spatter weight detection means for detecting ~~the~~ a weight of spatter produced during ~~the~~ a workpiece welding time;

a deposited metal weight computation means for computing ~~the~~ a weight of welding wire metal deposited on the workpiece, based on values detected by the supplied wire weight detection means and spatter weight detection means; and

a welding quality assessment means for comparing an output value of the deposited metal weight computation means with a reference standard value, and assessing a weld quality acceptability based on the degree of separation of the output value from the reference standard value.

**Claim 4. (currently amended)** ~~An~~ The arc welding quality evaluation apparatus characterized in that it comprises ~~a~~ of claim 1, wherein the welding quality assessment means ~~that~~ computes a molten metal cross-sectional area of ~~a~~ the workpiece, using a first conversion diagram for converting an output value of ~~an~~ the effective heat input computation means ~~according to Claim 1~~ to a workpiece molten cross-sectional area, compares the molten metal cross-sectional area to a molten reference standard value, and

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assesses weld quality acceptability based on the degree of separation of the molten metal cross-sectional area from the molten reference standard value.

**Claim 5. (currently amended)** ~~An~~ The arc welding quality evaluation apparatus characterized in that it comprises a of claim 3, wherein the welding quality assessment means ~~that~~ computes a deposited metal cross-sectional area of ~~a~~ the workpiece, using a second conversion diagram that converts an output value of ~~a~~ the deposited metal weight computation means ~~according to Claim 3~~ to a deposited metal cross-sectional area, compares the deposited metal cross-sectional area to a deposited reference standard value, and assesses weld quality acceptability based on the degree of separation of the deposited metal cross-sectional area from the deposited reference standard value.

**Claim 6. (currently amended)** ~~An~~ The arc welding quality evaluation apparatus characterized in that it comprises a of claim 4, further comprising:

a supplied wire weight detection means for detecting the a weight of welding wire supplied; and

a deposited metal weight computation means for computing the a weight of welding wire metal deposited on the workpiece, based on values detected by the supplied wire weight detection means and spatter weight detection means;

wherein the weld quality assessment means computes a deposited metal cross-sectional area of ~~a~~ the workpiece, using a second conversion diagram that converts an

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output value of a the deposited metal weight computation means to a deposited metal cross-sectional area, compares the deposited metal cross-sectional area to a deposited reference standard value, and assesses weld quality acceptability based on the degree of separation of the deposited metal cross-sectional area from the deposited reference standard value;

wherein the welding quality assessment means that computes an effective cross-sectional area by subtracting the deposited metal cross-sectional area according to Claim 5 from the molten metal cross-sectional area according to Claim 4, compares the effective cross-sectional area to a an area reference standard value, and assesses weld quality acceptability based on the degree of separation of the effective cross-sectional area from the area reference standard value.

**Claim 7. (currently amended) An** ~~The arc welding quality evaluation apparatus according to any one of Claim 1 through 6 characterized in that it comprises a~~ of claim 6, wherein in the weld quality assessment means, the heat input, deposited metal weight (the weight of welding wire metal deposited on the workpiece, the molten metal cross-sectional area, the deposited metal cross-sectional area, and the effective cross-sectional area, are computed as average values over the workpiece welding time, each average value is compared to a reference standard value set to the respective average value during optimum welding conditions, and weld quality acceptability is assessed based on the degree of separation of the average value from the reference standard value.